Federal Democratic Republic of Ethiopia

EDICT OF GOVERNMENT

In order to promote public education and public safety, equal justice for all, a better informed citizenry, the rule of law, world trade and world peace, this legal document is hereby made available on a noncommercial basis, as it is the right of all humans to know and speak the laws that govern them.

ET 698 (2002) (English): PESTICIDES - GOOD PRACTICE FOR GROUND AND AERIAL APPLICATION

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

ETHIOPIAN
STANDARD

ES 698:2002

(Reaffirmed: 2012)

First edition

Pesticides Good practice for ground and aerial application

ICS: 65.100.01

Published by Ethiopian Standards Agency

©ESA

Foreword

This Ethiopian Standard has been prepared under the direction of the Technical Committee for Pesticides (TC 19) and published by the Ethiopian Standards Agency (ESA).

The standard is a reaffirmation for reprint of the Ethiopian Standard ES 698:2002, Pesticides-Good Practices for ground and aerial application, with some editorial changes without altering the technical contents in the former text.

Pesticides — Good practice for ground and aerial application

1 Scope

This Ethiopian Standard specifies the general requirements for ground and aerial application of pesticides

2 Normative reference

The following Ethiopian Standard contains provisions, which, through reference in this text, constitute the provisions of this Ethiopian Standard. At the time of publication the edition indicated was valid. All standards are subject to revision and parties to agreements based on this Ethiopian Standard are encouraged to investigate the possibility of applying the most recent edition of the Ethiopian Standard indicated below. Registers of currently valid standards are maintained in the Ethiopian Standards Agency.

ES 693, *Pesticides – Terminology.*

3 Definitions

For the purpose of this Ethiopian Standard, terms defined in ES 693 shall apply.

4.What to use

4.1 In order to control pests and diseases the farmer must:

4.1.1 identify the pest;

4.1.2 know what control methods are available;

4.1.3 evaluate the benefits/risks of each method or combination;

4.1.4 choose the methods that are cost effective yet cause the least harm to man and the environment; and

4.1.5 know how to use the selected control method(s) properly, know what regulations apply.

4.2 Pesticides are but one of the control measures which can be used to control pests and diseases. This Ethiopian Standard develops some common sense practices, which when followed, will assist in ensuring that pesticides are safely and effectively applied.

5. Before applying the pesticide

5.1 Correctly identify the problem and estimate the extent of damage being done - if not sure, seek advice from a government advisory officer, company adviser or neighbour.

5.2 Seek advice on alternative methods of control and use a pesticide only where necessary - remember there may be some cases where the side effects of a pesticide may make the problem worse.

5.3 Use only the pesticide recommended for the problem. If several materials are available, use the one which has the lowest hazard - not only to the applicator but to neighbours and the environment

5.4 READ THE LABEL - make sure the pesticide is:

©ESA

5.4.1 Registered in Ethiopia;

5.4.2 suitable for the intended use;

5.4.3 suitable for application to the particular crop at the time proposed;

5.4.4 able to be applied in time to leave the required withholding period between spraying and harvest or grazing;

5.4.5 the one that is least likely to cause drift problems, if it drifts off the target; and

5.4.6 One, which is least likely to cause problems to humanbeings,animals,beneficial insects, natural enemies and the environment

5.4.7 Make sure the appropriate protective clothing, as recommended on the label, is available and is in a fit condition to wear - ensure that it has been washed since last using.

5.4.8 Make sure that all those individuals that are involved with the application are fully aware of the operation - take time out to fully brief all those involved in all aspects of the application.

5.4.9 Ensure that the right application machinery for the job is used and that it is in good order - it is good practice to always check the equipment before it is put away to see that it is in good repair.

5.4.10 Check to ensure that the equipment is clean and that any worn parts are replaced with correct new parts - keep a limited supply of spares on hand; e.g. washers, nozzles.

5.4.11 Ensure that the equipment is leak proof and correctly calibrated - obtain calibration charts from Government advisers, Company representatives or machinery suppliers. Faulty calibration can cost money, and render the operation unsafe.

5.4.12 Make sure there is enough pesticide on hand to complete the job - don't run out half way through, as by the time further supplies are available it may be too late as the pest may have already done the damage.

5.4.13 Warn neighbours of the intended application, especially if they are close to the area intended to be sprayed - good neighbourliness may save a lot of problems later.

6.While mixing the pesticide and during application

6.1 Wear the required protective clothing. If it becomes contaminated, remove it and replace with clean clothing - wet saturated clothing provides an ideal source for skin absorption.

6.2 DO NOT work in wet contaminated clothing

6.3 Try not to work alone when using the more hazardous materials - this is very important when spraying in an isolated area. If adversely affected, the operator may not be able to obtain help.

6.4 Never allow children or unauthorized people near the mixing area - dregs can kill - a number of children have died because of obtaining access to dregs in the bottom of an apparently empty container.

6.5 Recheck the instructions on the label - don't rely on memory - use rates are many and varied.

6.6 Avoid spilling the pesticide on the skin particularly the concentrate - pour liquid formulations carefully to avoid splashing. Be careful to avoid powder formulations dusting up into the face. If the pesticide is spilt on the skin, wash it off immediately.

6.7 Never eat, drink or smoke while mixing or applying pesticides- avoid practice which may increase the risk of absorption.

6.8 Have clean water on hand for washing - very important before eating, smoking or going home after the job.

6.9 Never blow out clogged nozzles with the mouth.

©ESA

6.10 Do not spray crops in flower or when weeds, which may be attractive to bees, are flowering - spray highly hazardous materials in the evening when the bees are not foraging -remember bees are working for you.

6.11 Spray in such a way so as to reduce drift by:

6.11.1 not spraying in a strong wind. The safest condition is when there is a steady breeze of less than 5 km/h blowing away from a sensitive area;

6.11.2 keeping the nozzles at an appropriate distance from the crop.

6.11.3 use appropriate pump pressure. High pressures produce more fine droplets, which drift further off the target area than bigger droplets. For boom spraying it is seldom necessary to exceed pressures of 300 kPa, and for gun spraying pressures in excess of 2000 kPa are seldom necessary; and

6.11.4 DO NOT SPRAY if wind conditions are not suitable.

Table 1 - Wind speed guide

Description	Approx air speed	Visible signs	Spraying
Calm	< 2 km/h	Smoke rises vertically	Avoid
Light Air	2-3 km/h by smoke drift	Direction shown	Avoid
Light Breeze	3-7 km/h wind felt on face	Leaves rustle,	Ideal
Gentle Breeze	7-10 km/h	Leaves and twigs in constant motion	Avoid using
Moderate	10-15 km/h	Small branches move Raises dust and Moves loose paper.	Application not advised

6.12 Never leave containers of concentrate unattended in the field - not only children but also stock can gain access, often with disastrous results.

6.13 Provide proper supervision to all those handling or applying the pesticide - make sure everyone involved knows what is going on.

7 After application

7.1 Return any unused pesticide to the store or secure area.

7.2 Dispose of empty containers by consulting the responsible local authority.

7.3 Safely dispose of any residual pesticides left in the spray tank following acceptable procedure.

7.4 Clean protective clothing and wash hands or any other part of body, which may be contaminated.

7.5 Clean the sprayer and decontaminate if necessary before changing from one type of pesticide to another.

7.6 Complete spraying records including amount of pesticide used, date of application, stage of growth of the crop, weather conditions at the time of spraying and any other appropriate details.

7.7 Do not allow other persons to enter the treated area for the required period if re-entry restrictions apply to the pesticide used.

8 Aerial application

While many of the points in clauses 4,5 and 6 apply to aerial applications, because of the size of the operation and the number of personnel involved, the following additional points should be noted:

8.1 The Pilot

8.1.1 The pilot should hold the appropriate licence/permit/ authority to apply the particular pesticide and be able to demonstrate his competence in the use of the pesticide chosen with respect to:

a) suitability for that particular operation;

b) application rates;

c) effects on the target area;

d) hazards to man, and effects they may have on non-target vegetation and animals, and special precautions to be taken because of this; and

e) first aid measures.

8.1.2 The pilot should only apply pesticides after he has taken steps to ensure that:

a) persons not involved in the application are outside the area to be treated and are sufficiently distant to avoid contact from any drift;

b) non-target crops, livestock (including fish and bees) or other property, including any body of water, which may be damaged or contaminated by the pesticide are not within the area to be treated, nor so nearby that there is a reasonable possibility of damage by drift; and

c) the pesticide will be substantially confined to the area to be treated.

8.1.3 The pilot should halt operations immediately if :

a) any person not involved in the operation is likely to be exposed to a hazardous pesticide;

b) a clear and immediate health hazard from drift occurs, or is likely to occur; and

c) vegetation, animals or property outside the target area have been or are likely to be exposed to a pesticide by drift.

8.1.4 The pilot must take precautions against becoming contaminated. To do this he must:

a) avoid all physical contact with the pesticides, contaminated application equipment, and contaminated surfaces;

b) wear appropriate protective clothing, which is changed every day or more often if it becomes contaminated;

c) shower and change as soon as possible after the flying is finished (or if contaminated by pesticides) and put used clothing out for washing;

d) not act as loader or mixer, clear or adjust spray nozzles, clean the aircraft of pesticides, fly with leaky application equipment, or fly through own spray cloud;

e) wash face, forearms and hands before eating, drinking or smoking and eat well away from the loading area;

f) ensure that all pesticide pressure lines except those leading to pressure gauges are mounted outside the cockpit so as to avoid exposure in the event of accidental leaking; and

g) have taken steps to have appropriate tests to monitor exposure before the beginning of the season and during the season at regular intervals.

©ESA

8.1.5 If the aircraft is likely to pass over a marker or other person, the pilot should ensure that the application equipment is switched off.

8.2 Loaders

Surveys have shown that of the spraying team, loaders are the most frequently contaminated by pesticides.

8.2.1 Loaders should be familiar with:

a) the common and/or the chemical names and trade names of the pesticides that they are handling;

b) hazards to humans and safety precautions to be followed because of this; and

c) first-aid measures.

8.2.2 Loaders should be competent in:

a) the correct method of measuring, preparing, mixing and loading of the pesticide;

b) the correct method of storing and handling the product;

c) the accepted method of cleaning up spills, and disposal of unwanted pesticide, prepared spray and containers;

d) the actions, effects and hazards of the pesticides being used including the ways in which they are absorbed;

e) first aid; and,

f) the availability of medical attention.

8.2.3 Loaders must wear the specified protective clothing and properly maintain it.

8.3 Markers

The use of human markers should be avoided wherever possible. Markers are in a potentially hazardous situation and special care to avoid exposure to pesticides, especially by way of skin absorption, should be taken.

8.3.1 Markers should have instruction in:

a) safety procedures they should take to avoid exposure to pesticides;

b) the names, hazards and routes of absorption of the pesticides being used;

c) decontamination and first aid procedures; and

d) safety procedures in agricultural flying.

8.3.2 Markers should:

8.3.2.1 wear protective clothing (a coverall, boots or shoes, and a washable wide brimmed hat) which must be changed for clean clothing daily,

8.3.2.2 shower and change as soon as the spraying is finished for the day or more frequently if clothing becomes wet,

8.3.2.3 when marking:

a) always work into wind;

b) never stand where exposure to pesticides or drift is most obvious;

c) where possible stand at least 50 m beyond the edge of the target area so that the aircraft is not spraying when it passes;

d) do not touch or walk through freshly sprayed crops;

e) move away upwind from mark when the aircraft is approaching and 300 m away on a spray run. If unable to get clear of aircraft, lie face down with hands beneath the body; and

f) at the turning end, move upwind when the aircraft is completing its turn and before the wings are level.

2 Controlled droplet application

Controlled droplet application (CDA), utilizes the correct droplet size to obtain maximum control of the target organism as well as maintaining a uniformity of droplet size. Different size droplets are used for herbicide, fungicide and insecticide application. Application is simple, with a spinning disc being driven by a battery and the pesticide falling by gravity when the bottle is inverted, onto the spinning disc. Either drift or placement spraying may be used.

2.1 Drift spraying

9.1.1 Note wind direction and walk progressively upward across the field through the untreated crop - smoke can be used to assess wind.

9.1.2 Check speed of disc and the batteries before starting to spray.

9.1.3 Hold disc about 1 metre above the crop and if there is a second sprayer operating ensure there is no drift towards him.

9.1.4 When the end of the row is reached, invert the sprayer to stop the flow.

9.1.5 Do not spray in extreme conditions, i.e. dead calm or in strong gusty wind.

2.2 Placement spraying

9.2.1 Hold disc a few centimetres above the weeds to be sprayed.

9.2.2 Hold the machine in such a way so that you need not walk through the sprayed area.

9.2.3 When the end of the row is reached, invert the sprayer to stop the flow.

10.2.4 Do not spray in extreme conditions, i.e. dead calm or in gusty/ windy conditions.

©ESA

Annex A

(Informative)

Control measures

There are a number of methods, which can be used to control pests. These include:

A.1 Host plant resistance

'The growing of crop varieties which are less vulnerable to the pest attack or which yield better than other under pest pressure.

A.2 Cultural control

Modifying cultivation practices, removal of alternate host plants, crop rotation, intercropping, trapcropping modification of planting dates.

A.3 Mechanical control

Hand weeding, traps, hand hoeing.

A.4 Physical control

Hot water treatment, grain drying.

A.5 Biological control

Using natural enemies to control the pests, either releasing these into the environment or allowing natural dissemination.

A.6 Chemical control

Pesticides.

A.7 Integrated pest management

In many cases acceptable control calls for a combination of some or all of the above methods to keep pest populations down to an acceptable level. The utilization of integrated pest management (IPM) makes use of all available means of control.

"Integrated pest management is a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest population at levels below those causing economically unacceptable.

©ESA

Annex B

(Informative)

Spray equipment and their calibration

B.1 Spray equipment for small scale farmers

B.1.1 Hydraulic knapsack sprayers

B.1.1.1 Calibration

Calibration of knapsack sprayer means working out how much concentrated pesticide to mix with water each time the sprayer is filled. If calibration is not carried out the dose may be too high which wastes pesticide, or it may be too low which may not control the pests or disease may lead to resistance and waste time and money. More overdosing may damage the crop or lead to residues in crop products, the soil or waterways.

B.1.1.2 Determine volume application rate (VAR)

The manufacturers recommended dose for a pesticide is usually given as the amount of products to mix with a given volume of water or the amount of product for a given crop area.

There may also be a given recommended volume of diluted liquid to apply per area of crop, referred to here as the Volume Application Rate (VAR).

Method A

Step 1: Measure and mark out an area of crop 10 m x 10 m (100m^2). Use a tape measure on your pace length.

Step 2: Measure the volume of the spray tank in l by noting the volume of clean water used to fill it to the base of the filter, or other convenient level. Alternatively, check the markings on the tank for an estimate of volume.

Step 3: Spray the measured area with the water using your normal spraying technique and find out how much you have used by measuring the amount of water needed to refill the sprayer, or checking the liquid level against the markings on the tank.

Step 4:Use the following formula to calculate the volume application rate. (VAR in l /ha)

Volume application rate (l/ha) = $\dfrac{volumeused(l)x10000m^2}{Areasprayed(m^2)}$

Example: Area of crop measured and sprayed = 10 x 10 = 100 m^2

- Amount of water refilled after spray = 2 l

- Volume application rate l/ha =?

Volume application rate (l/ha) = $\frac{2l x 10000 m^2}{100 m^2}$

= 200 l/ha

Method B

Step 1: Determine swath width. Partly fill the sprayer with water and attach the appropriate nozzle. Select a dry target area e.g. concrete ground, holding the nozzle at the correct height spray stationary. Measure the wetted area, which shows a uniform dark band, repeat three times and calculate the average swath width in m.

Step 2: Determine walking speed. Mark out a line at least 100m long and put a stake at each end. Start spraying and walk at comfortable speed along the line while spraying correctly. Measure the distance walked in exactly one min. Repeat the operation and calculate the average walking speed in m/min.

Step 3:Determine-sprayer output. Adjust the pressure at the required level and pump the sprayer using steady strokes and collect the spray in dry bucket, or other container, for exactly one min; measure the water collected in the bucket.

Repeat the operation and calculate the average output in l /min using the following formula.

Volume application rate (l/ha) = $\frac{sprayoutput(l/\min) x 10000 m^2}{wakingspeed(m/\min) x swathwidth(m)}$

e.g. Average swath width measured = 2m

Average walking speed = 60m/min

Average spray output = 2.4 l/min

Volume =?

Volume application rate (l/ha) = $\frac{2.4 l/\min x 10000 m^2}{60 m/\min x 2m}$

= 200 l/ha

B.1.1.3 Determining dilution rate for each sprayer tank

Having known the volume application rate /ha, one can calculate the amount of formulation needed for each sprayer tank.

To find out how much product /tank filling:

- Calculate the number of sprayer load /ha using this formula;

Load /ha = $\dfrac{volumeapplicationrate}{\tan kcapacity}$

eg. Computed volume application rate = 200 l/ha

Capacity of sprayer to be used. = 20 l (cp-20)

Number of sprayer loads = $\dfrac{200l/ha}{20l/spray}$

= 10 tank full of solution

To calculate the amount of product per tank filling, use the following formula;

$$amountofproduct/\tan kfilling = \frac{recommendedproductdosage/ha}{numberofsprayerloads/ha}$$

eg. Amount product recommended /ha = 2 l

Number of sprayer loads /ha = 10 sprayers

∴ Amount product / tank filling = 2 l/ha

=10 sprayer /ha

= 0.2 l/sprayer or we can use the following formula:

$$amountofproduct/\tan k = \frac{productapplicationratex\tan kcapacity}{volumeapplicationrate}$$

e.g. Product application rate = 2 l/ha

Volume application rate = 200 l/ha

Tank capacity = 20 l

Amount / tan = $\dfrac{2l/ha\ x\,20\ l}{200l/ha}$

$$= \frac{40}{200}$$

= 0. 2 l/sprayer

B. 1.1.4 Cleaning and storing the sprayer

Having completed the spraying in the field, the sprayers should be, cleaned and stored in proper condition.

A procedure for cleaning and storing the sprayer:

- Spray out any remaining pesticide mixture over crops.

- Take off sprayer lid and place to one side upside down.

- Remove lid filter and tap out any solid deposit in this and then pour some water through the filter. Replace lid filter in tank.

- Shake sprayer vigorously.

- Remove the lid, put it aside upside down and remove the lid filter and place on up turned lid for safety. Swirl remaining water around in tank and tip out on bare ground to remove and solid matter form the tank.

Remember safety precautions.

- Replace lid filter and again quarter fill the tank with water and replace lid. Pump out the **water** thigh the nozzle to remove any pesticide inside the pump, pressure chamber and hose

- At the end of the season, the sprayer must be washed thoroughly, nozzles, filter and hoses removed and the sprayer stored away form direct sunlight. All water must be drained from the sprayer. Damage and broken parts must be replaced.

B. 1.1.5 Maintenance

The Knapsack Sprayer is usually of simple design, which lends itself to local maintenance. Therefore, the operator should maintain the sprayers after an appreciable period of operations.

During maintenance, seals, gaskets and hoses must be regularly examined for wear, and pump seals, diaphragm and valves must be frequently checked and replaced if damaged.

B. 1.2 Ultra Low Volume (ULV) Spray

3 B .1.2.1 Calibration of hand-held spinning disc sprayers

Calibration involves setting the forward speed (s), the distance between spray passes, called track spacing (T) and the flow rate of the sprayer to give the correct pesticide dose. If calibration is not curried out, the dose may be too high which wastes, or it may be too low which may not control the pest, waste time and money.

B. 1.2.1.1 Procedures

a) Determine track spacing

Measure the track spacing by spraying a suitable flat target of the spray area holding the sprayer at the recommended height above the target and within the limit of wind speed. Oil sensitive papers are used to observe the distance droplets reached.

b) Application rate (l/ha)

The Manufacturer or Agricultural officers usually recommend the application rate of the product per hectare and details are usually given on the label of container.

c) Determine Walking Speed (m/min)

Using a measuring tape mark out a distance at least 100m and measure the time it takes to go form one end to the other at normal speed carrying the sprayer.

Make all the measurement three times and take the average.

NOTE - If wrong units are used, the formula will give the wrong answer and wrong dose will be applied. Be sure to check the units and convert them if necessary to the units in the formula above.

d) Calculate the flow rate using the following formula.

Flow rate (l/min)= $$\frac{trackspacing(m)\,x\,applicationrate(l/ha)\,x\,speed(m/\min)}{10000}$$

Having known the required flow rate to apply the recommended pesticide, select a restrictor, which could give you the calculated flow rate. If any of the sprayer restrictor could not give the calculated flow rat, adjust the speed of the operator to apply the recommended dose.

eg. Required spray volume /application rate/ = l /ha

Spray pass interval = 5 m

Waking speed = 60 m/min

Flow rate =?

Flow rate (l/min) = $$\frac{trackspacing(m)\,x\,applicationrate(l/ha)\,x\,waking\ speed(m/\min)}{10000}$$

$$= \frac{5x60}{10000}$$

= 0.3 l/min

If the flow rate of the restrictor (Feed nozzle) match with the calculated flow rate, use the restrictor with the 0.3 l/min output.

But if the calculated flow rate does not much with any of the restrictor, use a restrictor which has a flow rate closest to the calculated flow rate 0.3 l/min and use the formula to adjust your walking speed to attain the recommended application rate.

If the calculated flow rate does not much with any of the restrictor and the closest flow rate you get is 0.025 l/min, use the flow rate to calculate your walking speed and practice walking it in one min.

Walking speed (m/min) = $$\frac{flowrate\ x\, 10000}{trakspacing\ x\ applicationrate}$$

$$= \frac{0.025 l / \min x 10000}{5m\ x 1l}$$

= 50 m/ min

Mark out a distance or 50 m and practice walking it in one min using 0.025 l/min flow rate output restrictor.

B .1.3 Motorized knapsack mist blowers

Motorized mist blowers need careful and regular maintenance and servicing. The engine runs on mixed fuel with oil according to the manufacturer's recommendation mostly in a ratio of 25 parts normal grade petrol to 1 part of two stoke oil.

B.1.3.1 Calibration

In order to calibrate your motorized knapsack sprayer

a) Fill the tank with water to a known level

b) Determine the width of the spray swath (m)

- Measure the width of the swath sprayed in m while keeping constant the distance between nozzle and ground level.

c) Determine walking speed of sprayman (m/min)

- Mark starting point with a stake in a field planted with the crops to be sprayed. Walk at a normal and constant speed for exactly one min and measure the distance traveled in a min.

d) Determine nozzle discharge (l/min)

- Fill the sprayer with a known quantity of water and spray with full throttle for one min.

- Measure how much water it takes to top up the tank to its previous quantity level.

e) Compute the volume of spray with the following formula:

Volume of spray per/ha = $$\frac{10000\ x\ flowrate}{speed\ x\ swath}$$

Amount product per tank filling = $\frac{2l/ha}{2\tan kful}$

= 1 l product per thankful of solution

$\therefore$ Tank capacity = 15 l

Product = 1 l

To prepare 15 l solution = 14 l water + 1 of actual spray solution product

B.2 Spray equipment for medium and large migratory outbreaks.

B.2.1 Broadcast application

B.2.1.1 Flow rate

Be it ground or aerial application, the flow rate always is calculated the same way: $F = \frac{R \times D \times A}{10000}$

Where:

F = flow rate per minute (l/min)
R = run width (m)
D = distance sprayed per minute (m/min)
A = application volume (l/ha)

- Run width *x* distance / min = area sprayed / min
- Area sprayed / min x thickness of deposit (l/ha)
  = Volume sprayed per minute
  = Flow rate per minute in l/min.

B.2.2 Band application (by ground spraying)

We recommend band treatments only if they can be carried out at the same time together with the sowing/planting operation (sowing-machine mounted spray equipment) or if there is a very special and steer able spray equipment available.

Band treatments are made either over the planting rows or between the rows. Considerable savings of product are possible with band treatments. The saving is equal to the surface not covered. On the strips treated, the full dose must be applied. The amount of product to be applied per ha of crop is therefore dependent on the ratio between bandwidth and planting distance of the rows.
In order to be able to carry out a band application, the nozzle spacing must be adjusted according to the planting distance.
Let us make an example in order to see better the former mentioned saving of product that can be obtained by band application.

B.2.3 Basics of tractor mounted boom sprayer

Boom length (R)	12 m	
Number of nozzles	24	
		12m
Nozzle spacing (adjustable)	50 cm	
Distance covered (speed 5 km/h) (D)	83.3 m/min.	
Tank content	600 l	

Application volume (A)	200 l/ha
Recommended amount of product	
For broadcast application	6 l/ha
Band width	40 cm
Planting distance	80 cm

$$F=\frac{R x D x A}{10000}=\frac{12 \text{ m} \times 83.33 \text{ m} \times 200 \text{ l}}{10000 \text{ m}^2} = 19.99 \text{ l/min(which is about 20 l/min)}$$

$$F/\text{nozzle} = \frac{20 \text{ l/min}}{24 \text{ nozzles}} = 0.83 \text{ l/min/nozzle}$$

Nozzle type to be used = 110 03 (SS) for broadcast application

- Nozzle spaying have to be adjusted to the planting distance of 80 cm

- Thus, we have now 15 nozzles on the boom of 12 m for band application instead of the former 24 nozzles for broadcast application. But we have to change the nozzles.

The =low -awe calculation for band application is the same as for broadcast application...

$$F=\frac{R \times D \times A}{10000}$$

... but taking into consideration, the ratio between planting distance and band width (treated surface)

$$F=\frac{R \times D \times A \times \text{band width}}{10000 \times \text{planting distance}}$$

$$F=\frac{12 \text{ m} \times 83.33 \text{ m} \times 200 \text{ l} \times 40 \text{ cm}}{10000 \text{ m}^2 \times 80 \text{ cm}}$$

F = 9.99 l/min, which is about 10 l/min.

- These 10 l/min are applied by the 15 nozzles for band spraying

$$\frac{10 \text{ l/min}}{15 \text{ nozzles}} = 0.66 \text{ l/min/nozzle}$$

Nozzle type to be used now for the band application 8002 E

Boom bight also have to be adjusted in order to spray the band width of 40cm

Thus, the surface treated by band application still get the same ...

. application volume of 200 l/ha
. amount of product 6 l/ha

... as for broadcast application, but effectively applied per ha are only:

$$200\ l/ha \times \frac{40\ cm}{80\ cm} = 100\ l/ha$$

$$6\ l/ha \times \frac{40\ cm}{80\ cm} = 3\ l/h$$

Thus, the saving of product in this case is 50% = 3 l/ha instead of 6 l/ha. With other words, if we have the same tank load as for broadcast application: 600 l in the tank with 18 l product, which is enough for an application of 3 ha broadcast, we are able to spray in this case 6 ha still applying the recommended amount of product of 6 l/ha over the treated surface.

B.2.4 Calibration of the flowrate for aerial application

Careful calibration of the flowrate is important for correct dosage at the target. The flowrate must be adjusted to the flying speed of the aircraft, the run width and the volume intended to be applied.

$$\text{Flowrate} = \frac{\text{flying speed x run width (m) x volume applied (l/ha)}}{\text{Conversion factor (k)}}$$

Flying speed mph, k = 373

Flying speed km/h, k = 600

Example

Low volume (LV)	**Ultra low volume (ULV)**
$\frac{90\,mph\ x\ 20\,m\ x\ 30\,l/ha}{373}$	$\frac{90\,mph\ x\ 25\,m\ x\ 3\,l/ha}{373}$
Flowrate = 144.8 l/min	**Flowrate = 18.1 l/min**

The total flowrate / min thus calculated, must now be checked, **flying at application speed:**

a) Fill the spray tank with 40-80 l water **(water only).**

b) Fly at application speed. Open the system and spray. As soon as the pressure collapses, shut the valve **at once.** Now the entire system is filled with water.

©ESA

c) Land and add the calculated total Flowrate **as water** to the tank.

From the examples above:

LV: 144.8 l

Since the spray mixtures prepared with water have nearly the same viscosity as pure water, this property can be neglected when calibrating.

ULV : 18.1 x factor 1.20 = 21.7 l

NOTE: Ready-to-use ULV products have a higher viscosity than water, which is why depending on the formulation, to boom.

d) Fly again at application speed. Spray the water and **measure the time elapsed until the pressure collapses**. (Close the valve again at once.)

If the time measured is:

- Exactly 1min: everything is OK, make a note of the valve position. Carry out a check with the product.

- More than 1 min: the total flowrate is too low, open the valve wider (if the valve is already wider open, select larger nozzles or a larger restrictor number)

- Less than 1 minute: the flowrate is too high, cut back the valve.

NOTE: " Check the new valve position, until the practical and the calculated flowrate coincide. (In the examples: LV approximately 145 l, ULV 22 l of water.)

e) Check the water-determined valve position with a further flight, **applying the product this time** (LV 145 l spray mixture; ULV 18 l ready-to-use product)

©ESA

የኢትዮጵያ የደረጃዎች ኤጀንሲ
Ethiopian Standards Agency

Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010.ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1970.

ESA's objectives are:-

- ❖ Develop Ethiopian standards and establish a system that enable to check weather goods and services are in compliance with the required standards,
- ❖ Facilitate the country's technology transfer through the use of standards,
- ❖ Develop national standards for local products and services so as to make them competitive in the international market.

Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government organizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/ or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes. Orders for all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch (Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed in from our website.

ESA has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of ESA.

International Involvement

ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the international Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM).It is a founding member of the African Regional Organization for standardization (ARSO).

More Information?
Contact us at the following address.
The Head Office of ESA is at Addis Ababa.

☎ 011- 646 06 85, 011- 646 05 65
📠 011-646 08 80
🖂 2310 Addis Ababa, Ethiopia
E-mail: info@ethiostandards.org,
Website: www.ethiostandards.org

Standard Mark

DRAFT